filled with the coolant and no vapor is present in the [at least one] water [rod] rods at [least at the end of the one fuel cycle] the another period.

57. (amended) A method according to claim 56, wherein the step of raising the coolant surface includes increasing the flow rate of the coolant in the range of 0% to less than 110% of the flow rate during the one period and the step of further increasing the flow rate of the coolant includes increasing the flow rate above 110% of the flow rate during the another period.

REMARKS

At the outset, while the Office Action is indicated as a final Office Action, the finality is traversed as being improper. Applicants note that the Office Action dated August 10, 1998 is the first Office Action on the merits with respect to claims 24-29 and 38-57, claims 24-29 only being considered based upon the Decision on Petition dated March 10, 1998, with the Office Action of April 23, 1998 being a restriction requirement and not an action on the merits. Accordingly, withdrawal of the finality is requested, noting that a Petition lies from the action taken on this request for the withdrawal of the finality. In the event that the finality is determined to be proper, a Notice of Appeal accompanies this amendment.

By the above amendment, claims 25, 27, 28, 38, 39, 44-49 and 51 have been cancelled, with the other claims being

amended to clarify features of the present invention in a manner which is considered to overcome the rejections under 35 U.S.C. §112, first and second paragraphs.

Turning to the rejection of claims 24-29 and 38-57 under 35 U.S.C. §112, first and second paragraphs, such rejections are traversed insofar as they are applicable to the present claims, and reconsideration and withdrawal of the rejections are respectfully requested.

At the outset, the Examiner indicates that while the specification refers to the presence of a pump, the pump cannot be the means or structure for accomplishing said "regulating", "controlling", etc. because the pump is just an apparatus or machine. Irrespective of the Examiner's contentions, the Examiner is referred to the specification at pages 41 and 42, which describes the feature that the recirculation conduit 69 is provided with a recirculation pump 70 and that the output of a high level of the nuclear reactor can be controlled by changing the number of revolutions of the recirculation pump 70 and by increasing or decreasing the flow rate in the reactor core. More particularly, as described at page 42, lines 8-25 of the specification of this application, there is described that the operation for shifting the flow condition in the water rod 19 from the condition of Fig. 3A to the condition of Fig. 3C, is achieved by <u>increasing the flow rate in the reactor core</u>, i.e. by <u>increasing the number of revolutions of the recirculation pump 70</u>. With the recirculation <u>pump running at a speed that produces the flow rate of smaller than 100%</u> in the reactor core, the condition

of Fig. 3A is established in the water rod 19, whereby the vapor is built up in the coolant descending path 26. With the recirculation pump running at a speed that produces the flow rate of greater than 110% in the reactor core, the condition of Fig. 3C is established in the water rod 19, and no vapor is built up. It can therefore be said that the recirculation pump 70 serves as a means that controls the accumulating amounts of voids (vapor) in the water rod 19. Applicants submit that this description is directed to a person skilled in the art to which the present invention pertains in accordance with the requirements of 35 U.S.C. §112, first paragraph, and irrespective of the Examiner's comments, applicants submit that the operation of the pump is clearly described in the specification in a manner sufficient to enable one of skill in the art to which it pertains to make and use the present invention, noting that the operation of a pump is well known in the art, as represented by U.S. Patent No. 4,440,715, issued in 1984 prior to the earliest filing date of the present application, copy of which patent is submitted herewith. Thus, irrespective of the comments by the Examiner, applicants submit that the application and claims should be considered to be in compliance with 35 U.S.C. §112, first and second paragraphs, as to an operation of a pump, which features have now been set forth in the present claims.

Additionally, as to the Examiner's indication of how the increasing in the flow rate takes place throughout the whole fuel cycle from the beginning of the cycle to the end of the fuel cycle, applicants note that the claims have been amended

to clarify such feature. Referring to claim 24, for example, and referring to Figs. 3A-3C of the drawings of this application, claim 24 has been amended to recite raising a coolant surface formed between the coolant and a vapor in the at least one water rod by increasing the flow rate of the coolant supplied to the core based on increasing a number of revolutions of the pump during one period from a beginning of one fuel cycle and before an end of the one fuel cycle, which features are illustrated in Figs. 3A and 3B of the drawings of this application. Claim 24 further recites the feature of further increasing the flow rate of coolant supplied to the core based on increasing the number of revolutions of the pump during another period after the one period to an end of the one fuel cycle in a state in which the at least one water rod is completely filled with the coolant, as illustrated in Fig. 3C of the drawings of this application. Thus, it is readily apparent that the specification and claims, as amended, should now be considered to be in compliance with 35 U.S.C. §112, first and second paragraphs, noting that all claims have been amended in a similar manner.

With respect to the Examiner's rejections of claims and comments concerning claims as not being proper method steps, it is noted that claims have been cancelled which avoid the rejections noted by the Examiner, and additionally, it is apparent that the recited method utilizes a recited structure, which structural features are properly set forth in the claims and which must be given proper consideration.

In view of the above amendments, applicants submit that all claims present in this application should be considered to be in compliance with 35 U.S.C. §112, first and second paragraphs.

Turning to the claims present in this application, applicants note that claims 24, 52 and 54 are the only independent claims present in this application, with the other claims depending directly or indirectly from the aforementioned independent claims. The features of independent claim 24 have been described above, and applicants note that similar features are recited in independent claim 52, which claim 52 more particularly defining the structural arrangement of the reactor vessel. Claim 54 also defines the structural arrangement of the reactor vessel, while reciting the steps of loading a plurality of the fuel assemblies in the reactor core and controlling the amounts of voids accumulated in the water rods by regulating a number of revolutions of the pump supplying coolant to the core. As pointed out above, such features are clearly described in the specification and drawings of this application.

In light of the cancellation of claims and the presentation of only independent method claims 24, 52 and 54 in this application, and in particular, the cancellation of claim 38 and many of the claims dependent thereon, the other claims dependent upon claim 38 being amended to depend directly or indirectly from claim 24, applicants consider it unnecessary to respond to the rejections set forth by the Examiner based upon claim 38. Applicants note that the

rejections as set forth in paragraphs 8, 9, 10, 11 and 12 are based upon a rejection of claim 38 and its dependent claims, and such rejections are considered to be obviated by the cancellation of claim 38, such that a discussion of the cited art in relation to claim 38 is considered to be unnecessary.

The rejection of claims 24, 25 and 50 under 35 U.S.C. §103(a) as being unpatentable over either Japan 0220686 or Japan 0031090 in view of Sofer is traversed insofar as it is applicable to the present claims, and reconsideration and withdrawal of the rejection are respectfully requested.

Turning first to Japan 0220686, applicants note that most of fuel assemblies are loaded in a core of a nuclear reactor during three fuel cycles and in this reference, an increase of the burn-up capability of the fuel assembly is obtained by controlling a void fraction in the fuel rod, because a cooling water surface is formed in the water rod of the fuel assembly during the first and second fuel cycles, and the water rod is filled with cooling water during the third fuel cycles. In this reference, the fuel assemblies of the first fuel cycle and the second fuel cycle, have a water rod fitted with a screw 11 having a narrow conduit, which screw 11 is fitted at a lower end plug. In contradistinction, the fuel assembly of the third fuel cycle has a water rod with the screw 11 removed. In one fuel cycle, a plurality of the fuel assemblies of the first fuel cycle, a plurality of the fuel assemblies of the second fuel cycle, and a plurality of the fuel assemblies of the third fuel cycle are loaded in the core. Even if the fuel rate of the cooling water supplied to

the core is increased from the beginning of the fuel cycle toward an end of the one fuel cycle, the water rods and the fuel assemblies of the first fuel cycle and the second fuel cycle are not filled with the cooling water in an end portion of the one fuel cycle nor during the another period, as now recited in claim 24 and other claims, for example. Further, the cooling water surface is not formed in the water rods of the fuel assemblies of the third fuel cycle during the another period, since the water rod is filled with the cooling water by utilizing a water rod with the screw 11 removed therefrom. The removal of the screw 11 from the water rod and the fuel assembly of the second fuel cycle is carried out during a shutdown period of the nuclear reactor before the next fuel cycle. The fuel assembly of the second fuel cycle is taken out of the nuclear reactor in order to remove the screw 11 from the water rod and the fuel assembly of the second fuel cycle having the screw removed from the water rod thereof is the fuel assembly of the third fuel cycle, i.e. in the next fuel cycle. Applicants note that the fuel assembly of the first fuel cycle is the fuel assembly of the second fuel cycle in the next cycle, and in the next fuel cycle, fuel assembly of the first fuel cycle is a new fuel assembly having screw 11 and loaded in the core during the shutdown period before the next fuel cycle. Applicants note that a fuel cycle is an operation period of a nuclear reactor from starting of the nuclear reactor to shutdown of the nuclear reactor, as described at page 15, line 34 to page 16, line 3 of the

specification of this application, and is accepted terminology in the art.

Applicants submit that the fuel assembly disclosed in Japan 0220686 does not utilize an increase of flow rate supplied to the core by increasing a number of revolutions of a pump supplying the coolant to the core during the periods, as set forth in claim 24 and the other claims of this application and does not provide for raising the coolant surface in the water rod during one period and then completely filling the water rod with coolant during another period after the one period, which periods are effected during one fuel cycle, as recited in the claims of this application. Thus, irrespective of the Examiner's contentions, applicants submit that this reference fails to disclose or teach the claimed features in the sense of 35 U.S.C. §103 and all claims patentably distinguish thereover.

As to Japan 0031090, applicants note that this reference corresponds to the disclosure of Japan 0220686 as described above, in that the water rods and the fuel assemblies of the first fuel cycle and the second fuel cycle are also fitted with a screw having a narrow conduit, wherein the screw is fitted at an upper end plug. In this reference, the fuel assemblies of a third fuel cycle are not provided with the screw in the water rod, such that water rod is completely filled with the cooling water by removing the screw. As such, applicants submit that Japan 0031090 is also deficient with respect to the claimed subject matter as pointed out above,

and all claims patentably distinguish thereover in the sense of 35 U.S.C. §103.

As to Sofer, it is noted that the Examiner has recognized the deficiencies of the Japanese references, but contends that while the primary reference may accomplish this change in flow by changing the size of an opening in the water rod, it was also a known alternative in this art that the necessary change in flow rate could also be accomplished by changing the flow rate at which the coolant is recirculated in the reactor system (as shown for example by Sofer) and, to so modify either primary reference would accordingly have been prima facie obvious. The Examiner is referred to the decision of In re Fine, 5 USPQ 2d 1596 (Fed. Cir. 1988), wherein the court pointed out that the PTO has the burden under §103 to establish a prima facie case of obviousness and can satisfy this burden only by showing some objective teaching in the prior art or that knowledge generally available to one of ordinary skill in the art would lead that individual to combine the relevant teachings of the references. As noted by the court, whether a particular combination might be "obvious to try" is not a legitimate test of patentability and obviousness cannot be established by combining the teachings of the prior art to produce the claimed invention, absent some teaching or suggestion supporting the combination. As further noted by the court, one cannot use hindsight reconstruction to pick and choose among isolated disclosures in the prior art to deprecate the claimed invention.

Turning now to Sofer, which applicants submit has been utilized in a hindsight manner, applicants note that Sofer describes a method for increasing the burn-up capability of BWR, wherein the increase of burn-up capability is accomplished by reducing the void fraction toward the end of the fuel cycle. This can advantageously be accomplished by providing additional recirculation flow pumping capability for increasing the flow rate near the end of the fuel cycle, but Sofer provides no disclosure or teaching concerning the utilization of a fuel assembly with water rods and operating in the manner as defined. Thus, it is apparent that the Examiner has engaged in a hindsight reconstruction attempt in complete disregard of the teachings of the individual references. Thus, applicants submit that claim 24 as well as all the other independent claims patentably distinguish over this proposed combination of references in the sense of 35 U.S.C. §103.

Applicants note that as pointed out above, none of the aforementioned cited art disclose or teach the features of the present invention that a coolant surface formed between the coolant and vapor is raised in the at least one water rod by increasing the flow rate of the coolant based upon an increase of revolution of a pump supplying the coolant to the core during one period from a beginning of one fuel cycle and before an end of the one fuel cycle and that subsequently, the flow rate of the coolant supplied to the core is increased during another period after the one period to the end of the one fuel cycle in a state in which the at least one water rod

is completely filled with the coolant. Applicants note that while the Examiner has suggested that it would be obvious to provide such features by a combination of the references, the Examiner's reasoning is erroneous. That is, a fuel cycle is an operation period of a nuclear reactor from starting up of the nuclear reactor to shutdown of the nuclear reactor, as pointed out above. Reference is made to Appendix I showing Fig. 5 of Japan 0220686 and Appendix II showing Fig. 6 of Japan 0031090, which show a change of the infinite multiplication factor during three fuel cycles (the first fuel cycle, the second fuel cycle, and the third fuel cycle). A new fuel assembly with the screw from the water rod being removed after the fuel assembly was disposed in the core during the two fuel cycles is disposed in the core during the third fuel cycle. The nuclear reactor is shutdown after each of the first fuel cycle, the second fuel cycle and the third fuel cycle for exchanging the fuel assemblies in the core. In the Japanese references, the fuel assemblies of the first fuel cycle and the second fuel cycle which have the screw therein form the cooling water surface in the water rod and the water rod of the fuel assemblies of the third fuel cycle which do not have the screw therein is filled with coolant water. Accordingly, neither of the Japanese references disclose the core in which in one fuel cycle, the fuel assemblies having the screw and the fuel assemblies not having the screw are disposed in the core in the manner set forth, and do not disclose that a water rod has a steam void therein during a first part of the fuel cycle representing one period, as now

recited in claim 24, for example, and is completely filled with water during a second part of the fuel cycle representing the another period after the one period and during the one fuel cycle by increasing the coolant flow rate. Accordingly, the Examiner's suggestion concerning the utilization of Sofer with the Japanese references represents a hindsight reconstruction attempt and does not result in the claimed features as set forth. Accordingly, applicants submit that all claims patentably distinguish over this cited art in the sense of 35 U.S.C. §103.

As to the rejection of claims 24, 25 and 50 as set forth in paragraph 14 at page 12 of the Office Action, this rejection is traversed insofar as it is applicable to the present claims.

Applicants note that the Examiner contends that the use of claimed flow rate percentages in either primary reference would have been prima facie obvious in view of the teachings thereof in the admitted prior art in the specification, referring to page 25 of the specification. Applicants note that the deficiencies of the cited art have been discussed above, and hereagain, this position by the Examiner represents a hindsight reconstruction attempt in complete disregard of the teachings of the individual references. Thus, applicants submit that all claims patentably distinguish over this proposed combination of references.

As to the rejection of claims 24-29 and 38-57 as set forth in paragraph 15 at page 12 of the Office Action, this rejection is traversed insofar as it is applicable to the

present claims, and reconsideration and withdrawal of the rejection are respectfully requested.

Applicants note that the Examiner has cited Patterson et al in addition to the aforementioned cited art, contending that it would be obvious to utilize the same to meet the claimed limitations.

Applicants note that Patterson et al discloses a fuel assembly which includes a water rod having a coolant ascending path and a coolant descending path connected with the coolant ascending path. A coolant inlet port of the coolant ascending path is open in a region lower than the fuel rod holding portion of the lower tie plate and coolant delivery ports of the coolant descending path are opened in a region higher than the fuel rod holding portion. The coolant delivery port of the coolant descending path is provided so as to cool a critical heat transfer zone of the fuel rods, wherein the critical heat transfer zone of the fuel rods are cooled by sub-cooled water jetted from the coolant delivery port in order to prevent damage of the fuel rods. Applicants submit that Patterson et al does not disclose or teach the features of the present invention related to raising a coolant surface formed between the coolant and vapor in at least one water rod by increasing the flow rate based upon increase of revolutions of a pump during one period of one fuel cycle and then increasing the flow rate during another period after the one period to the end of the one fuel cycle in a state in which the at least one water rod is completely filled with the coolant. Applicants note that in Patterson et al, if a

coolant surface is formed in the coolant descending path, vapor is jetted from the coolant delivery port and the critical heat transfer zone of the fuel rods is not cooled by the vapor, such that the temperature of the critical heat transfer zone would rise and it is apparent that such is not the intent of Patterson et al and represents a hindsight reconstruction attempt by the Examiner. Thus, applicants submit that all claims patentably distinguish over this proposed combination of references in the sense of 35 U.S.C. §103.

As to the rejection of the claims under 35 U.S.C. §103 further utilizing Matzner as set forth in paragraph 16 at page 13 of the Office Action, this rejection is traversed insofar as it is applicable to the present claims, and reconsideration and withdrawal of the rejection are respectfully requested.

Applicants note that the deficiencies of the other cited art have been discussed above, and Matzner also fails to disclose or teach the claimed features. Irrespective of the structure of Matzner, applicants submit that this patent does not overcome the deficiency of the other cited art in relation to the raising of the coolant surface during one period in the manner defined nor the increasing the coolant flow rate to provide a state in which the water rod is completely filled with coolant during another period of the one fuel cycle after the one period in the manner set forth. Hereagain, applicants submit that the Examiner has engaged in hindsight reconstruction attempt in complete disregard of the teachings

of the individual references and that all claims patentably distinguish over this proposed combination of references.

As to the rejections set forth in paragraphs 17, 18 and 19 at page 15 of the Office Action, such rejections are traversed insofar as they are applicable to the present claims, and reconsideration and withdrawal of the rejections are respectfully requested.

It is noted that with respect to the rejections set forth in paragraph 19, the Examiner has additionally utilized the reference to Kumpf. Applicants note that all the other references have been discussed as well as the deficiencies thereof, such that applicants will comment on Kumpf. In Kumpf, all the coolant is supplied into a compartment 11 which is introduced in a region among fuel rods 1 by passing through a U-shaped tube 32 because the fuel rod holding portion of the compartment 11 does not have a penetrated opening in order to introduce the coolant from the compartment 11 to the above-mentioned region other than the U-shaped tube 32. Applicants submit that a coolant surface between coolant and vapor does not form in the U-shaped tube 32. Irrespective of the Examiner's contentions, applicants submit that Kumpf, taken alone or in any combination with any of the other cited art, fails to provide the claimed features as set forth in the independent and dependent claims of this application, such that all claims patentably distinguish thereover in the sense of 35 U.S.C. §103.

With respect to the rejection of claims 24-29 and 38-57 as being provisionally rejected under 35 U.S.C. §101,

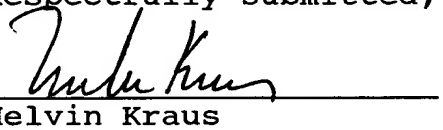
applicants note that the copending application referred to by the Examiner is no longer pending, such that this provisional rejection should be obviated.

In view of the above amendments and remarks, applicants submit that all claims present in this application should be considered to be in compliance with 35 U.S.C. §112, first and second paragraphs, and that all claims patentably distinguish over the cited art and should now be in condition for allowance. Accordingly, issuance of an action of a favorable nature is courteously solicited.

Applicants consider that an interview may be helpful in resolving any outstanding matters in this application, and the Examiner is requested to contact the undersigned attorney upon taking this application up for examination so as to schedule an interview.

To the extent necessary, applicant's petition for an extension of time under 37 CFR 1.136. Please charge any shortage in the fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account No. 01-2135 (501.25507CX5) and please credit any excess fees to such deposit account.

Respectfully submitted,



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